(12) UK Patent Application (19) GB (11) 2 160 289 A

(43) Application published 18 Dec 1985

(21) Application No 8415172

(22) Date of filing 14 Jun 1984

(51) INT CL⁴
F16L 55/18

(52) Domestic classification
F2P 32
B2F 102 209 306 318 EA
U1S 1573 1592 1884 B2F B2L F2P

(56) Documents cited

GB A 2085321	GB 1533024	GB 0970308
GB A 2084048	GB 1187590	GB 0936036
GB A 2056887	GB 1121342	GB 0852474

(58) Field of search
F2P
B2F
B2L

(71) Applicant
British Gas Corporation (United Kingdom),
152 Grosvenor Road, London SW1V 3JL

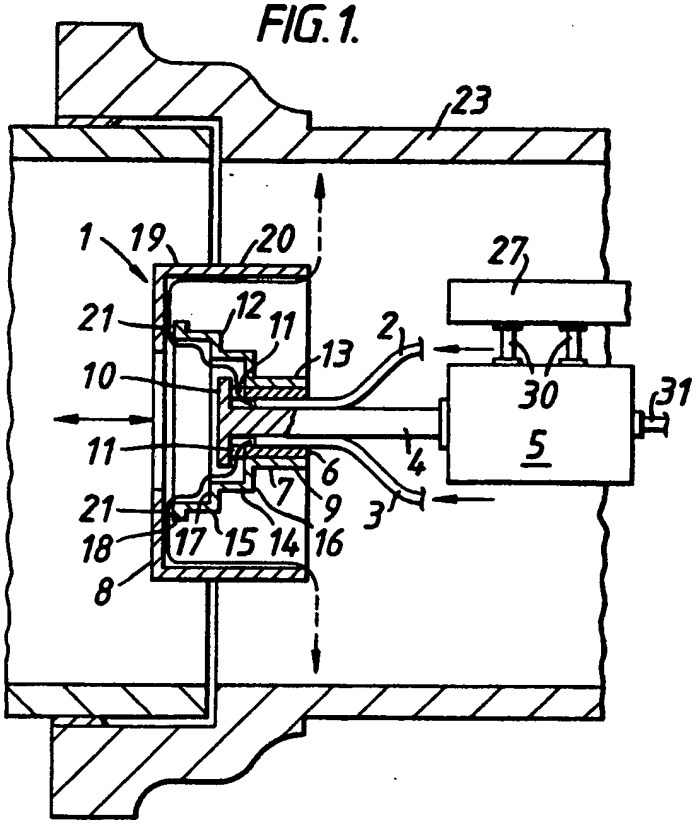
(72) Inventors
Kevin Eric Arnold
Peter Michael Wardle

(74) Agent and/or Address for Service
David J Morgan,
British Gas Corporation, 326 High Holborn, London
WC1V 7PT

(54) Spray-sealing of pipes

(57) Apparatus for sealing a joint or leak in a pipeline or main comprises a synthetic resin distributor 1 of the spinning cup type for location within the pipeline or main at a point adjacent to the joint or leak, tubes 2 and 3 for delivering resin to the distributor for mixing therein and a motor driven shaft 4 for rotating the distributor 1 at high speed so that the components mix within the distributor 1 and issue therefrom as atomised droplets for deposition upon the inner wall of pipeline or main 23 as a layer. The distributor may comprise an inner cup 6 having one end closed by a flat disc 10 secured to the shaft 4, a second cup 7 in the form of a truncated stepped cone and an outer cup 8 which is also a shallow cone.

FIG. 1.



GB 2 160 289 A

2160289

FIG.1.

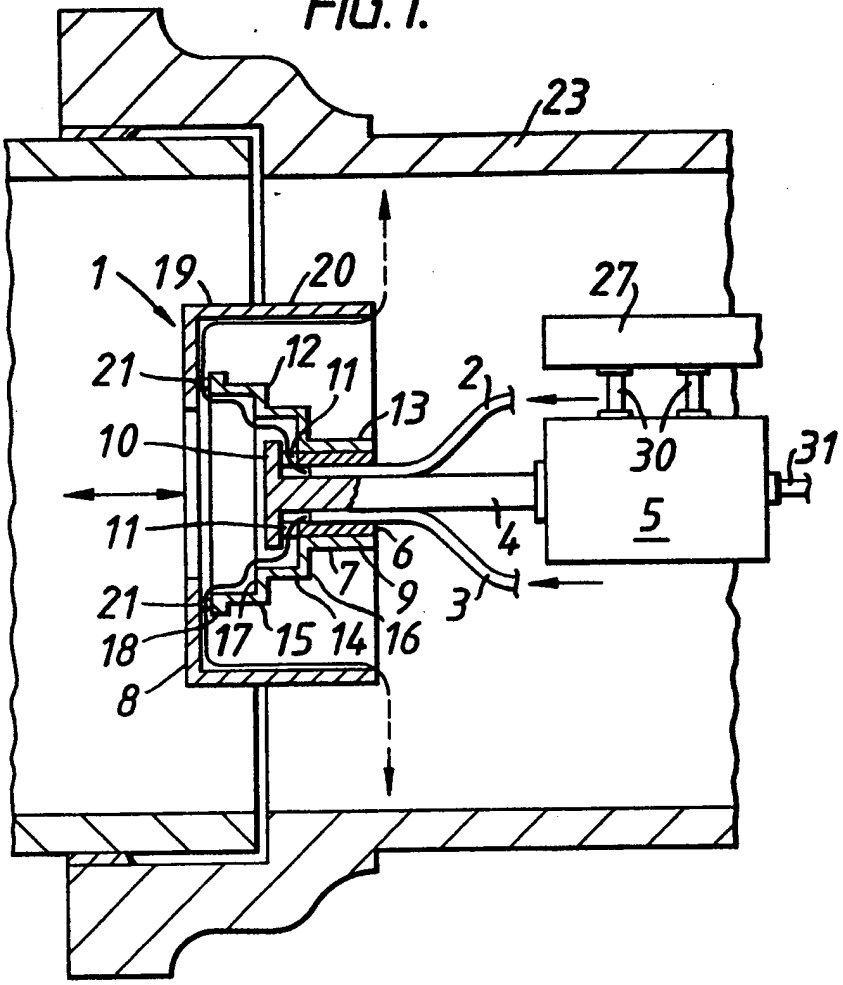
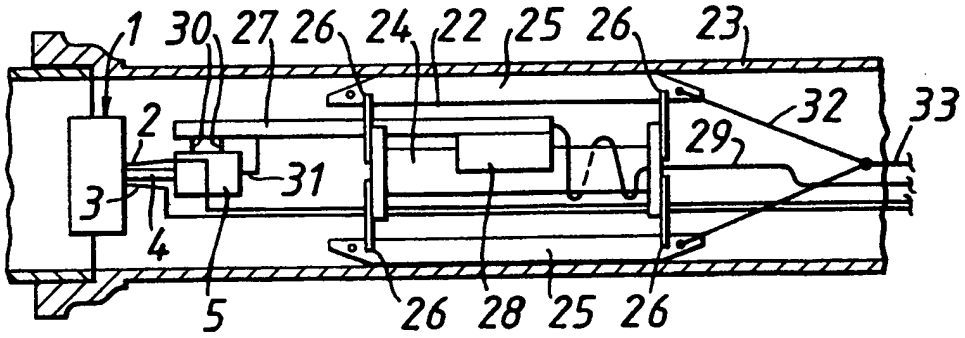


FIG.2.



SPECIFICATION

Spray sealing joints internally

The present invention relates to the sealing of a joint or leak in a pipeline or main and particularly to the sealing of joints and leaks in underground gas pipelines or mains.

It is now common for underground pipelines or mains laid many years ago to develop leaks. In the case of gas pipelines or mains such leaks may occur at the joints due to shrinkage of the yarn. The leaks may also develop due to structural damage or in the case of pipelines or mains carrying water, sewerage or other fluids due to corrosion. If the pipeline or main is large enough, a man can enter the pipeline or main and repair the leak in situ.

In the cases where the pipeline or main is too small for a man to enter it, the joint or leak must be sealed remotely.

A method for such sealing involves spraying a layer of resin onto the inner wall of the pipeline or main to form a lining with portions on either side of the joint or leak, some of the lining covering the joint or leak to seal the same, the spraying being performed by a device which is located within the pipeline or main and is caused to travel therealong sealing the joints or leaks in turn.

The sealant commonly used takes the form of a synthetic resin of two or more components which after mixing react to form a polymer. The mixed resin components are sprayed onto the inner wall of the pipeline or main to form a lining sealing the joint or leak.

The spray device may take the form of a cup or the like which is spun at very high speed on its longitudinal axis. The resin components premixed in so-called dynamic or static mixers are pumped to the cup which swirls the components around and ejects them centrifugally as atomised droplets from the edge of the cup. The droplets are deposited on the inner wall of the pipeline or main where after curing they form a lining around the wall and seal any joints or leaks located beneath the lining.

One problem with the existing technique described is that there is a tendency for the resin to cure prematurely within the mixer before it is discharged to the cup. This problem is particularly prone to occur with fast gelling resins and can lead to blockage of feed lines, apart from possibly necessitating time consuming cleaning of the mixer before further use of the device.

It is therefore an object of the present invention to at least mitigate this problem.

According therefore to one aspect of the present invention a method is provided for sealing a joint or leak in a pipeline or main, the method comprising locating within the pipeline or main a synthetic resin distributor of the spinning cup type, moving the distributor to a point adjacent to a joint or leak, injecting into the distributor as discrete streams the components of the synthetic resin while simultaneously spinning the distributor at such a speed that the components mix within the cup and then issue therefrom centrifugally in the form of atomised droplets for deposition upon the inner wall of the pipeline or main to form a layer to seal the joint or leak and allowing or causing the deposited resin to cure.

According to another aspect of the present invention apparatus is provided for sealing a joint or leak in a pipeline or main, the apparatus comprising a synthetic resin distributor of the spinning cup type for location within the pipeline or main at a point adjacent to the joint or leak, means for injecting into the distributor as discrete streams the components of the synthetic resin, and means for spinning the cup at such a speed that the injected components mix within the distributor and then issue from the distributor in the form of atomised droplets for deposition upon the inner wall of the pipeline or main to form a layer sealing the joint or leak.

An embodiment of the invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a section along the longitudinal axis of the distributor shown in situ within a gas main.

Figure 2 is a side view of the apparatus in position in a gas main.

Referring to the drawings, Figure 1 shows a resin distributor 1, delivery tubes 2 and 3 for supplying the discrete resin components to the distributor 1, a drive spindle 4 for rotating the distributor 1 at high speed and an air motor 5 for rotating the spindle 4.

The resin distributor 1 comprises three coaxial cups, 6, 7 and 8 as shown in Figure 1. The inner cup 6 comprises a cylindrical drum 9 having one end closed by a flat disc 10 which is of slightly larger diameter than that of the drum itself. The resin delivery tubes 2 and 3 extend through the open end of the drum 9 and terminate adjacent to the disc 10 on either side of the spindle 4. The spindle 4 is secured to the disc 10 so as in use to rotate the disc 10. The wall of the drum 9 is provided with several circumferentially spaced perforations 11 adjacent to the disc 10 to serve as outlets for discharge of the resin from the drum 9 to the second cup 7.

The second cup 7 is in the form of a truncated hollow stepped cone 12 having an apex in the form of a cylinder 13 which forms a sleeve for the drum 9 and is secured thereto. The cone 12 is arranged so that it opens out in a direction away from the resin delivery tubes 2 and 3. Each of the risers 14 and 15 of the steps comprise portions of cones with a shallow angle (less than 1° to

the horizontal as viewed in Figure 1). The treads 16, 17 and 18 of the steps extend radially outward, the tread 18 forming the base of the cone 12. cone 20 from the apex of which an annular portion 21 extends radially inwardly. The annular portion 21 is bolted to the base 18 of the second cone 12 by means of circumferentially spaced bolts 21, there being spaces left between the bolts 21 for discharge of the resin from the second cup 12 to the third cup 19. The cone 20 also has a shallow angle (less than 1° to the horizontal) and widens out in a direction opposite to that in which the second cone 12 widens out. The mixed resin finally leaves the distributor from the rim of the cone 20 in the form of atomised droplets taking the path shown by the arrow in Figure 1.

Referring to Figure 2, the pipe sealing apparatus comprises the distributor 1 mounted on the forward end of a carriage 22 located within a gas main 23. The carriage 22 comprises a central support shaft 24 and three angularly spaced skids 25 (only two shown) secured at either end of the shaft 24 by brackets 26. A boom 27 is mounted slidably on a saddle 28 on the shaft 24, the boom 27 reciprocating axially in use. The boom 27 is driven by compressed air supplied by an air hose 29 connected to the rear end of the boom 27. The air motor 9 for providing motive power to rotate the distributor 1 is mounted on the forward end of the boom 27 by means of the mounting members 30. The boom 27 is provided with an air outlet3l by means of which air is supplied to the air motor 9 to drive the spindle 4 which extends from the air motor 9 to the central cup of the distributor 1. The resin feed lines 2 and 3 extend rearwardly from the distributor 1 to a pump (not shown) for pumping the resin components from reservoirs (not shown) to the distributor 1.

While not shown, a joint locator may be mounted on the carriage 22. The Locator may be in the form of a TV camera or electromagnetic device and serves as a means for identifying joints to be sealed by the apparatus. At the rear end of the carriage 22 a winch cable hitch 32 is provided for attachment to a winch cable 33 to enable the apparatus to be winched through the main 23.

In use of the apparatus, the length of main containing the joints to be sealed is identified and gas flow in this length is terminated temporarily. Excavations are then dug at either end of the main and portions of the main are broken away to enable the operator to gain access to the main. A stiff rod is then pushed up the main from the near end to the far end where a winch is positioned. The rod is attached to the cable of the winch and the rod is then pulled back through the main pulling the cable back with it. The cable 33 (see Figure 2) is then secured to the hitch 32 of the carriage 22 which is positioned at the near end of the main.

The winch at the far end of the main is operated to pull the carriage through the main until the joint locator locates the first joint. The air compressor is then distributor 1 to spin on its axis. The resin components are then pumped along the feed lines 2 and 3 at such a pressure that the streams of resin leaving the lines impinge on the surface of the disc 10 in the drum 6.

The components are swirled within the drum 6 and issue therefrom by way of the outlets 11. The components then further mix on the inner surface of the stepped cone 12 before leaving this cone and entering the outer cup 19 for further mixing on the inner surface of the cup 19. Finally, the now thoroughly mixed components issue centrifugally from the rim of the cone 20 in the form of atomised droplets which after deposition upon the inner wall of the main react together to form a polymer.

By reciprocating the boom 27, a layer of resin is deposited with portions on either side of the joint, the resin layer when aired forming an effective joint seal.

Each joint is sealed in turn in a like manner until all the joints have been sealed. At this stage the carriage will be positioned at the far end of the main. It is then winched out of this end and the cables are detached from it. The main is then reconnected to the adjacent parts of the main by conventional techniques. Finally the excavations are back-filled.

The distributor 1 should be rotated at several thousand revolutions per minute to ensure thorough mixing of the resin components.

The stepped surface of the cone 12 acts as a weir which shears the mixture as it travels over it to provide a thinning out and thorough mixing of the components. The shallow angle of the cones also increases the residence time of the resin in the spinning distributor, also promoting enhanced mixing.

If the distributor is spun for a period after supply of the resin components to the distributor has ceased, almost all the mixture will be removed from the distributor so that very little cleaning of the distributor will be necessary.

Unlike devices utilising static and dynamic mixers for premixing, the resin components are entirely mixed within the distributor. There is therefore no danger of the resin curing before reaching the distributor and blocking feed lines. Consequently there is much reduced back pressure compared with the devices using a mixing chamber containing static or dynamic mixers. This is particularly important for very fast gelling resins. Because of this, relatively small bore resin feed lines can be used.

In addition, the use of a cup distributor has

advantages over a nozzle type sprayer. In the latter type of device the nozzle orifice can become blocked especially when fast gelling resins are used. In our distributor there is very little risk of blockages occuring.

Furthermore there is very little additional energy imparted to the mixed resin compared with devices using a conventional dynamic mixer. This type of mixer is known to cause heating of the resin and this can lead to the resin curing too rapidly.

The term "joint" used throughout this specification includes all joints whether leaking or not. Sealing nonleaking joints serves of course as a preventative measure.

The term "leaks" used throughout this specification includes leaks caused by fissures, fractures and the like.

CLAIMS

1. A method for sealing a joint or leak in a pipeline or main, the method comprising locating within the pipeline or main a synthetic resin distributor of the spinning cup type, moving the distributor to a point adjacent to a joint or leak, injecting into the distributor as discrete streams the components of the synthetic resin while simultaneously spinning the distributor at such a speed that the components mix within the cup and then issue therefrom centrifugally in the form of atomised droplets for deposition upon the inner wall of the pipeline or main to form a layer to seal the joint or leak and allowing or causing the deposited resin to cure.

2. A method as claimed in Claim 1 in which the distributor includes a cup in the form of a cylindrical drum having an open end to receive the resin components, a closed end opposite to the open end and at least one outlet in its wall to discharge the components from the drum.

3. A method as claimed in Claim 2 in which the closed end of the drum is flat and forms a surface upon which the resin components impinge after initial injection.

4. A method as claimed in Claim 2 or Claim 3 in which the wall of the drum isperforated to form outlets to discharge the resin components from the drum.

5. A method as claimed in any of Claims 2 to 4 in which the outlet or outlets is or are located adjacent to the closed end of the drum.

6. A method as claimed in any of claims 2 to 5 in which the distributor includes a second cup arranged coaxially with and secured to the drum, the second cup being in the form of a truncated hollow cone which is stepped and arranged so that the resin components discharge into the cone near to its apex and travel along the inner stepped surface of the cone and then discharge from the cone at a point at or near the base of the cone.

7. A method as claimed in Claim 6 in which the cone is arranged so that its base is more distant from the drum than its apex.

8. A method as claimed in Claim 6 or Claim 7 in which the distributor includes a third cup arranged coaxially with and secured to the second cup, the third cup being in the form of a hollow truncated cone which is arranged so that the resin components discharge into the cone near to its apex and travel along the inner surface of the cone before discharge at the base of the cone.

9. A method as claimed in Claim 8 in that the third cup is arranged so that its base is more distant from the base of the second cup than is its apex.

10. A method as claimed in Claim 9 in which the third cup is provided with an annular portion extending radially inwardly from the apex of the cone, the annular portion being attached to the base of the second cup in such a manner as to permit resin components to discharge from the second cup against the portion to flow thereover before reaching the inner surface of the cone.

11. Apparatus for sealing a joint or leak in a pipeline or main, the apparatus comprising a synthetic resin distributor of the spinning cup type, for location within the pipeline or main at a point adjacent to the joint or leak, means for injecting into the distributor as discrete streams the components of the synthetic resin, and means for spinning the cup at such a speed that the injected components mix within the distributor and then issue from the distributor in the form of atomised droplets for deposition upon the inner wall of the pipeline or main to form a layer to seal the joint or leak.

12. Apparatus as claimed in Claim 11 in which the distributor includes a cup in the form of a cylindrical drum having an open end to receive the resin components, a closed end opposite to the open end and at least one outlet in its wall to permit discharge of the components from the drum.

13. Apparatus as claimed in Claim 12 in which the closed end of the drum is flat and forms a surface for impingement thereon by the resin components upon discharge from the injecting means.

14. Apparatus as claimed in Claim 12 or Claim 13 in which the wall of the drum is perforated to form outlets for discharge of the resin components from the drum.

15. Apparatus as claimed in any of Claims 12 to 14 in which the outlet or outlets is or are located adjacent to the closed end of the drum.

16. Apparatus as claimed in any of Claims 12 to 15 in which the distributor includes a second cup arranged coaxially with and secured to the drum, the second cup being in the form of a truncated hollow cone which is stepped and arranged so that the resin components discharge into the cone near to its

apex for travel along the inner stepped surface of the cone before discharge at a point at or near the base of the cone.

17. Apparatus as claimed in Claim 16 in which the cone is arranged so that its base is more distant from the drum than its apex.

18. Appparatus as claimed in Claim 16 or Claim 17 in which the distributor includes a third cup arranged coaxially with and secured to the second cup, the third cup being in the form of a hollow truncated cone which is arranged to that the resin components discharge into the cone near to its apex for travel along the inner surface of the cone before discharge at the base of the cone.

19. Apparatus as claimed in Claim 18 in which the third cup is arranged so that itsbase is more distantfrom the base of the second cup than is its apex.

20. Apparatus as claimed in Claim 19 in which the third cup is provided with an annular portion extending radially inwardly from the apex of the cone, the annular portion being attached to the base of the second cup in such a manner as to permit resin components to discharge from the second cup against the portion for flow thereover before reaching the inner surface of the cone.

21. A method substantially as hereinbefore described with reference to the accompanying drawings.

22. Apparatus substantially as hereinbefore described with reference to the accompanying drawings.

Printed in the United Kingdom for
Her Majesty's Stationery Office, Dd 8818935, 1985, 4235.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.